

## PATENT SPECIFICATION



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## COMPLETE SPECIFICATION.

## Method and Apparatus for Mixing, Emulsifying, and/or Atomising.

I, JOHAN ERNST NYBOP, of 18, Upsalagade, Copenhagen, Denmark, a Danish subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

The present invention relates to a method of and apparatus for mixing or emulsifying and/or atomising.

It is known that if a liquid is conducted to the central part of the surface of say a circular plate, or disc revolving rapidly around its centre, the said liquid will spread over the disc in the form of a thin layer or film, the thickness of which is, at any point, inversely proportional to the third power of the distance of the respective point from the centre and the centrifugal force will have the effect of producing tension within the said film so that the cohesion between the particles of the liquid is destroyed and the film will be torn into pieces, or in other words, the liquid is formed into drops.

If, for instance, two liquids which are insoluble in each other are conducted to the centre of a rotating member the action to which the liquids are subjected as hereinbefore described will, to a considerable degree, favour the formation of an emulsion and by such means it is possible, with an extremely low consumption of power, to produce finer emulsions than obtained by the usual mixing or emulsifying mills.

According to this invention the method of emulsifying and/or atomising liquids or liquid-gas mixtures consists in conducting a liquid mixture or liquid-gas mixture to be emulsified and/or atomised or a liquid to be atomised to the central part of a rapidly revolving member constituted by two horizontal discs or plates having the space between them filled,

with the exception of a central part, with material which like wire netting or glass wool or granulated pumice will form obstacles against which the liquid mixture, liquid-gas mixture or liquid is continuously thrown in its passage to the edges of said discs.

A form of construction of an apparatus for carrying into effect the method according to the invention is illustrated diagrammatically by way of example, in the accompanying drawings in vertical section, wherein

1 designates a container in which is accommodated a shaft 2 adapted to be rapidly rotated, whilst 3 designates a supply pipe for the liquid or liquid mixture or liquid and gas to be treated.

Connected to the shaft 2 are two circular, horizontal plates 8, which are secured one to another in any suitable manner and spaced one from the other, the space between them being, with the exception of a central part 9, filled with wire netting, glass wool or other filling material 10.

The liquid or mixture of liquids or liquid-gas mixture which is supplied to the central space 9, will when the disc is rotated, spread on the obstacles, for instance the wires of the wire netting or the fibres of the glass wool on being caused to travel outwardly towards the circumference of the disc. Thus the liquid or liquid-gas mixture will be continuously thrown from wire to wire, or from fibre to fibre of the filling material 10 and is thus effectively emulsified or atomised.

The liquid or mixture of liquids or liquid-gas mixtures will leave the revolving member in a very finely atomised state—the size of the particles being of the order of  $\frac{1}{1000}$  of a millimetre or less—so that the apparatus is well adapted for use as an atomising apparatus and

thus may, for example, be used as an atomiser in a carburetter.

If a liquid-gas mixture is used a very high pressure can be obtained from the rotation, by which pressure the process of emulsification and/or atomisation is facilitated.

By way of example only three exemplifications of the working of the method and apparatus will now be given.

(1) On causing a mixture of oil and an aqueous solution of albumen to pass through such a revolving member as hereinbefore described, an emulsion in the form of a fine rain is produced which coming into contact with warm air led for example into the container is dried and yields a powder soluble in water which preserves its colloidal properties and produces with water an emulsion.

(2) On passing a mixture composed of a fatty oil or oils, an emulsifying agent and an aqueous solution of alkali through such a revolving member as is shown, an emulsifying and saponifying action will take place with the result that the usual boiling operation in soap manufacture is rendered unnecessary and a profitable production of soap, even in small plants, is made possible.

(3) On passing liquid naphthalene and hydrogen under pressure through such a revolving member, said revolving member containing a filling material having catalytic properties such as nickelized pumice, hydrogenation takes place and hydrogenised naphthalene results.

The container 1 may be heated or cooled or warm or cold currents of air may be passed therethrough. The filling material 10 may, if desired, have catalytic properties or be covered or impregnated with catalytically active substances. Furthermore the liquid or liquids (under which terms I include for the purposes of this invention true liquids, solutions, extracts etc. and in the case of liquids, also suspensions containing solid substances and colloidal solutions) could, if desired, be introduced through the shaft 2.

Again heated or cooled gas, gases or vapours or mixtures of the same, while not entering or completely entering into the composition of the final products, can be introduced under pressure into the space 9 for the purpose of increasing the emulsifying and/or atomising effects. Finally the invention could be made applicable for cracking hydrocarbons, with or without the aid of hydrogen.

I am aware that it has been proposed to atomise or spray liquids by feeding the liquids to the central space between two vertical rotating discs provided with a plurality of concentric rings of perforated or reticulated material such as wire gauze, with or without the addition of porous or absorbent material within the outer spaces formed therebetween for the bleaching, purification or filtration of the liquids treated, but according to this invention the material 10 filled as it is between the discs improves considerably the emulsifying and/or atomising effects.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A method of emulsifying and/or atomising liquids or liquid-gas mixtures according to which the liquid mixture or liquid-gas mixture to be emulsified and/or atomised or the liquid to be atomised is conducted to the central part of a rapidly revolving member constituted by horizontal discs or plates having the space between them filled, with the exception of a central part, with material which, like wire netting or glass wool or granulated pumice, will form obstacles against which the liquid mixture, liquid-gas mixture or liquid is continuously thrown in its passage to the edges of said discs.

2. A method of emulsifying and/or atomising as claimed in Claim 1, according to which gases or vapours or mixtures thereof, not of necessity entering the composition of the final product, are introduced under pressure into the central space between the rapidly rotating discs.

3. Apparatus for emulsifying and/or atomising liquid mixtures or liquid-gas mixtures or atomising liquids, substantially as described with reference to the annexed drawing.

4. Liquid emulsions, mixtures, suspensions, colloidal solutions of the like and/or the dried products therefrom when prepared by the method and apparatus above claimed.

Dated this 3rd day of April, 1924.

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